(12) UK Patent Application (19) GB (11) 2 251 790 (13) A

(43) Date of A publication 22.07.1992

(21) Application No 9100818.5

(22) Date of filing 15.01.1991

(51) INT CL[5]
A62C 3/16

(52) UK CL (Edition K)
A5A A31

(56) Documents cited
GB 2216791 A

(58) Field of search
UK CL (Edition K) A5A
INT CL[5] A62C

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(54) Flameproof housing

(57) A flameproof housing comprises a substantially cylindrical hollow body (1) closed at one end thereof and a labyrinth seal (9) secured to the other end of the body. The labyrinth seal (9) incorporates a stationary element (20) secured to the other end of the body (1) and a rotatable element (10) which is engageable with the stationary element (20) to provide a labyrinth path within the seal (9). The rotatable element (10) incorporates means such as a central hub and a drive shaft (16) for transmitting rotary drive through the seal, for example from a DC motor (4).

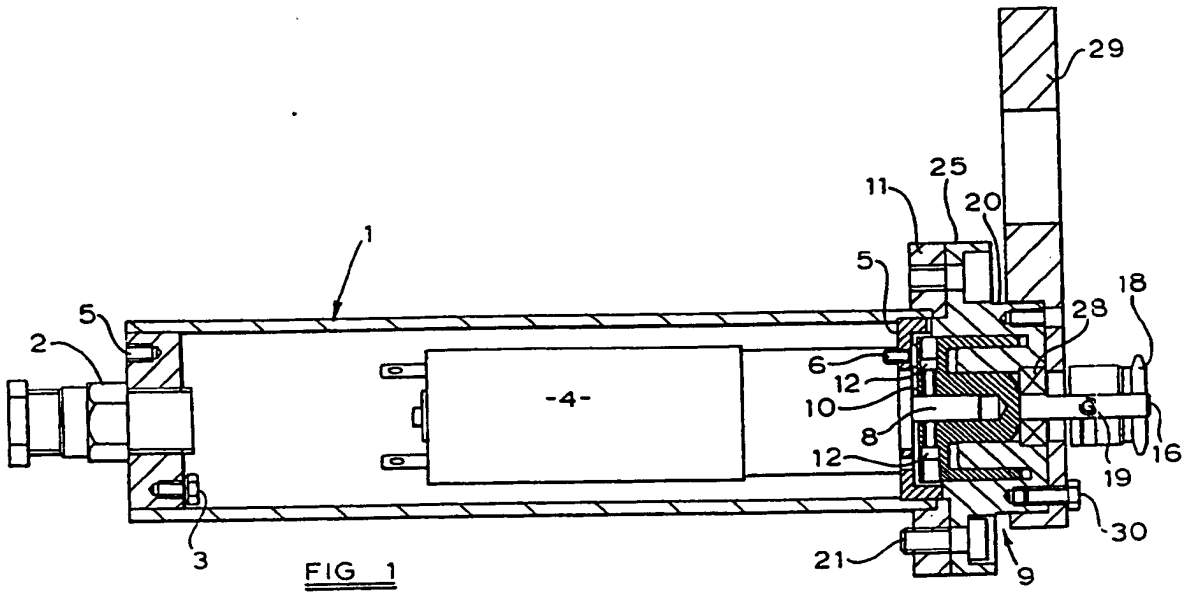

FIG 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

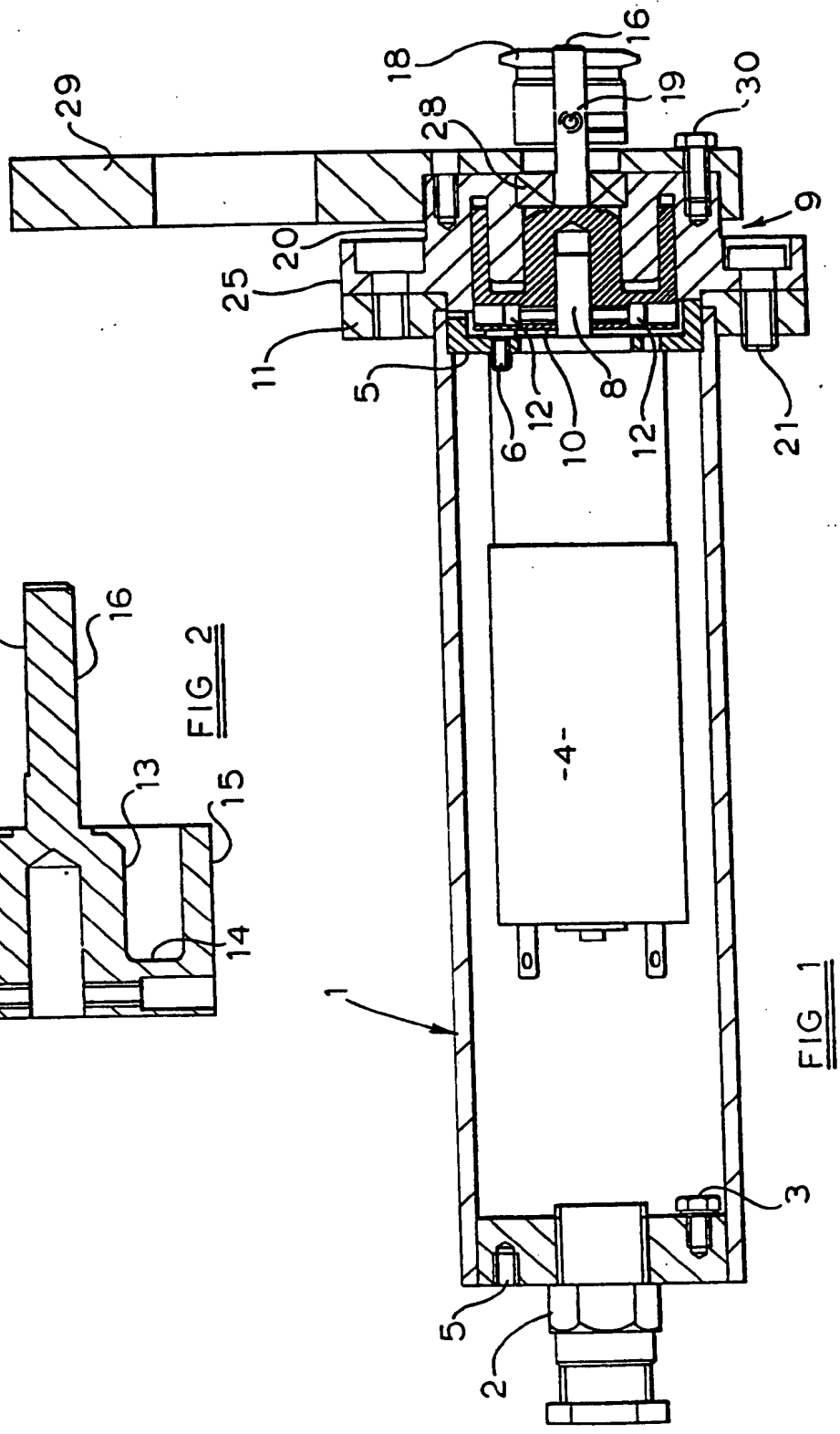

FIG 1

FIG 2

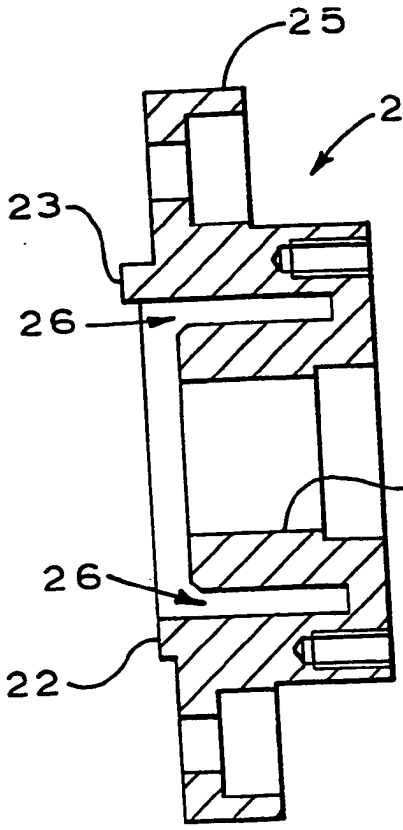

FIG 3

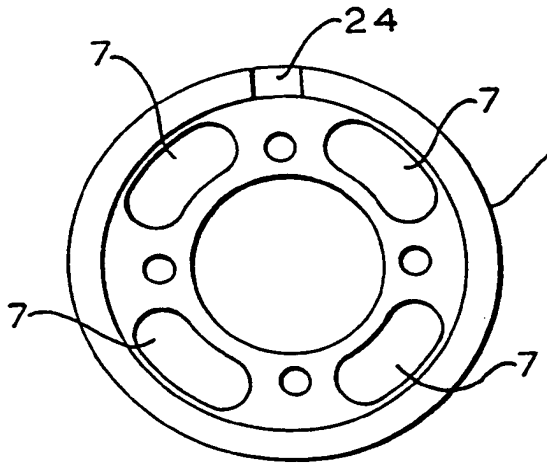

FIG 4

FLAMEPROOF HOUSING

The present invention relates to a flameproof housing which incorporates a rotary connection. Such a flameproof housing may be used, for example, to house an electrical motor in an environment which contains flammable material.

Flameproof housings for components which incorporate a rotary shaft, such as electric motors, are difficult to construct because of the need to provide a rotary drive connection through the housing. We have found there is no commercially-available flameproof housing for a DC motor and in particular we have found there is no flameproof housing which is compact in the axial direction of the rotary drive.

It is an object of the present invention to provide a flameproof housing which incorporates a rotary connection and which is compact in the axial direction of the rotary connection.

According to the present invention there is provided a flameproof housing which comprises a substantially cylindrical hollow body closed at one end thereof and a labyrinth seal secured to the other end of the body, the labyrinth seal incorporating a stationary element secured

to the body and a rotatable element which is engageable with the stationary element to provide a labyrinth path within the seal, which rotatable element incorporates means for transmitting rotary drive through the seal.

The rotatable element of the labyrinth seal may be substantially cup-shaped with an axially extending portion of the cup engaging in a channel formed in the stationary element so as to provide a labyrinth path. The stationary element of the labyrinth seal may include an axially extending cylindrical surface which lies adjacent to a central hub of the rotatable element so as to provide a part of the labyrinth path.

A bearing may be provided between the stationary element and the rotatable element of the labyrinth seal.

A gland seal may be provided in the closed end of the substantially cylindrical hollow body.

A flange for mounting an electrical motor within the housing may be provided in the other end of the substantially cylindrical body. The flange may be a push fit within the body. The flange may be keyed to the stationary element of the labyrinth seal to prevent rotation of the flange relative thereto.

For a better understanding of the present invention and to show more clearly how it may be carried into effect reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a side elevational view, partly in section, of one embodiment of a flameproof housing according to the present invention with an electrical motor positioned within the housing;

Figure 2 is a cross-sectional view to a different scale of the rotary portion of a labyrinth seal of the housing shown in Figure 1;

Figure 3 is a cross-sectional view to a different scale of the stationary portion of the labyrinth seal of the housing shown in Figure 1; and

Figure 4 is an end view to a different scale of a motor flange of the housing shown in Figure 1.

Figure 1 shows a housing 1 which may be machined from a single block of material such as stainless steel. The cross-sectional hatching of some of the components of Figure 1 have been omitted for clarity. As an alternative to machining the housing 1 from a single block, the housing may comprise a hollow cylinder having an end piece welded

in one end thereof. The advantage of the use of a single block is that, although material costs may be higher, the need to pressure-test the housing is avoided. An external flange 11 is formed at the open end of the housing 1 and a flameproof gland seal 2 is secured in an aperture formed in the closed end of the housing 1, for example for the passage of an electrical cable. An earth screw 3 for earthing a component such as a DC electric motor 4 within the housing is threaded into the internal side of the end of the housing, while a threaded recess 5 is provided on the external side of the end of the housing for earthing the same.

The motor 4 is connected to an electrical cable (not shown in the figures) which is secured in the gland seal 2 and to the earth screw 3 by a lead (also not shown) in such a way that the length of the cable and of the lead facilitates connection to the motor 4. As can be seen from Figures 1 and 4, a motor flange 5, for example of stainless steel, is secured to that end of the motor 4 adjacent the open end of the housing 1 by a number of screws 6, only one of which is shown in the figures, and the motor flange 5 is push fitted into a recessed portion of the open end of the housing. This construction of the housing 1 and motor flange 5 enables the motor 4 to be inserted into the housing and removed therefrom by way of an aperture in one end only of the housing. The motor flange 5 is formed with apertures,

four arcuate apertures 7 as shown in Figure 4, to ensure free communication between the inside of the housing 1 and a rotary seal to be described hereinafter.

In order for the housing to be flameproof, the drive from a drive shaft 8 of the motor 4 is by way of a rotary labyrinth seal 9. The advantage of a labyrinth seal is that the axial length of the seal is kept to a minimum in order to minimise any out-of-balance forces from the drive shaft 8. The labyrinth of the seal 9 may extend generally axially or generally radially, but the axial direction as shown in the figures is to be preferred for ease of mounting the motor.

A rotatable element 10 of the gland seal 9 is secured to the drive shaft 8 of the motor 4 by way of two grub screws 12 threaded radially into the element 10 and bearing against the drive shaft 8. As can be seen from Figure 2, the rotatable element 10 comprises a central hub 13, a radially extending portion 14 and an axially extending portion 15 defining together a cup-shaped element 10. Projecting axially from the hub 13 of the rotatable element is a drive shaft 16 which is formed with a flattened face 17 for keying into a sprocket 18 or other drive means such as a drive pulley. A grub screw 19 is used to secure the sprocket 18 onto the drive shaft 16. The rotatable element 10 may be made of stainless steel.

A flange 25 of a stationary, or non-rotatable, element 20 of the labyrinth seal 9 is secured to the flange 11 of the housing 1 by screws 21, only one of which is showen in the figures. The surface area and surface finish of the mating faces of the flange 11 and of the flange 25 are such that no gasket need be provided between the mating faces. As can be seen from Figures 1 and 3, the element 20 includes a flange 22, which projects a short distance into the interior of the housing 1, and a projecting key 23 which engages with a recess 24 provided in the periphery of the motor flange 5 so as to prevent rotation of the motor 4 without the need for any apertures to be formed in the body of the housing. The non-rotatable element 20 is formed with a channel 26 which receives the axially extending portion 15 of the rotatable element 10 and with an axially extending cylindrical surface 27 which lies adjacent to the central hub 13 of the element 10. Together the rotatable element 10 and the non-rotatable element 20 define a labyrinth path for communication between the inside of the housing 1 and the outside thereof which has a length greater than the flame path of any flammable gas within the housing. Mounted within a part of the cylindrical surface 27 is a bearing 28, which may have a stainless steel shield, for supporting the drive shaft 16 of the rotatable element 10.

The flameproof housing may be mounted on an apparatus, represented in Figure 1 by a flange 29, by way of screws 30, only one of which is shown in the figures, threaded into the non-rotatable element 20.

The construction of the flameproof housing shown in the figures makes it possible to exchange the motor 4, if it should fail, in a relatively quick and simple manner having regard to the flameproof nature of the housing. Thus, if the motor should fail it is not necessary to discard the entire assembly and a replacement motor can be fitted without difficulty.

Flameproof housings such as the present housing may be used in the cosmetics industry and elsewhere for example for checkweighing pressurised containers such as aerosols which are increasingly being filled with flammable butane as a propellant in place of chloro-fluoro-carbon gases. The use of a labyrinth seal, and more particularly the cup-shaped nature of the rotatable element, make it possible to construct a flameproof housing which is compact in the axial direction. Clearly the shape of the rotatable and non-rotatable elements can be varied and, for example, the radial extent of the radial portion 14 and the axial extent of the axial portion 15 can be changed, as can the number of radial or axial portions.

CLAIMS

1. A flameproof housing which comprises a substantially cylindrical hollow body closed at one end thereof and a labyrinth seal secured to the other end of the body, the labyrinth seal incorporating a stationary element secured to the body and a rotatable element which is engageable with the stationary element to provide a labyrinth path within the seal, which rotatable element incorporates means for transmitting rotary drive through the seal.

2. A flameproof housing as claimed in claim 1, wherein the rotatable element of the labyrinth seal is substantially cup-shaped with an axially extending portion of the cup engaging in a channel formed in the stationary element so as to provide a labyrinth path.

3. A flameproof housing as claimed in claim 1 or 2, wherein the stationary element of the labyrinth seal includes an axially extending cylindrical surface which lies adjacent to a central hub of the rotatable element so as to provide a part of the labyrinth path.

4. A flameproof housing as claimed in any preceding claim and including a bearing provided between the stationary element and the rotatable element of the labyrinth seal.

5. A flameproof housing as claimed in any preceding claim and including a gland seal provided in the closed end of the substantially cylindrical hollow body.

6. A flameproof housing as claimed in any preceding claim and including a flange for mounting an electrical motor within the housing provided in the other end of the substantially cylindrical body.

7. A flameproof housing as claimed in claim 6, wherein the flange is a push fit within the body.

8. A flameproof housing as claimed in claim 6 or 7, wherein the flange is keyed to the stationary element of the labyrinth seal to prevent rotation of the flange relative thereto.

9. A flameproof housing substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.